



Indigenous technical knowledge on the medicinal uses of natural resins and gums in India

Nandkishore Thombare*, Usha Kumari, Priyanka Sakare, Arnab Roy Chowdhury, Vaibhav D Lohot & Niranjan Prasad

ICAR- National Institute of Secondary Agriculture, Namkum, Ranchi 834 010, India

*E-mail: nandkishore.icar@gmail.com

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India has a rich heritage of species biodiversity. Many plant species and their products, especially resins and gums, have been used by people through Indigenous Technical Knowledge (ITK) to cure several ailments, including complex diseases, for ages. Due to the probable side effects of modern drugs, the trend for using traditional medicines is increasing. Natural resins and gums (NRGs), which are mostly exudated from plants to heal their injuries, comprise a balance of nutrients, energy, and various phytoactive compounds and hence possess high medicinal values. It is required to document know-how related to the use of herbal products so that they can be scientifically established for exploring their potential. This review discusses the medicinal benefits of important natural resins and gums to highlight their potential and popularity as a medicine.

Keywords: Gum, Herbal, Plant, Resin, Traditional medicine

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India shares eight percent of the world's biodiversity with only 2.4% global geographic area. Due to its diverse terrain and climatic conditions, India shelters around 47000 and 89000 species of plants and animals, respectively^{1,2}. About 66% of the India's population inhabits rural areas, mainly in the vicinity of the forests. Humans acquire food, medicine, and other utility products from the plants available in the forest. The close association of humanity with forests facilitated observation and exploitation of various plant products against multiple ailments. As a result, diverse indigenous technical knowledge (ITKs) was established using such plant products. As recognized by the World Health Organization³, traditional medicines are the sum of knowledge, skills and practices based on principles, beliefs and experiences indigenous to different cultures that can be used to maintain health. It is used to prevent, diagnose, and treat physical and mental illness⁴.

Why ITK-based traditional medicine?

Traditional medicines may not be a complete replacement for modern medicines. However, it still works as a valid alternative as it is cost-effective, has easy and widespread availability, and has a low risk

of side effects. The reason for the wide acceptability of such medicines, especially among rural people, is the low level of technological input required for their preparation and its connection with their customs and traditions. Also, for lesser known pathogens like the coronavirus, traditional medicines are the suggested immune boosters and cures in some instances.

Global scenario

About 80% of the world's population uses traditional medicines to treat various diseases⁵. The WHO's goal of *health for all* would not be achieved without these traditional plant-derived medicines. The demand for natural products like medicinal plants, herbal medicines, health products, pharmaceuticals, food supplements, nutraceuticals, and cosmetics is increasing day by day.

In most developing countries, more than half of the population depends on traditional medicines for treating several illnesses⁶ (as shown in Fig. 1). The countries where traditional medicines play an essential role in meeting the population's health needs⁷ are indicated in Figure 2.

What are natural resins and gums (NRGs)?

Natural resins: The resins are hydrocarbon secretions from the specialized cavities of many plant

*Corresponding author

species, especially coniferous trees. In plants, they are formed in particular types of structures known as ducts and are secreted in response to an injury or stress^{8,9}. Except for lac, the only natural resin of animal origin produced by the lac insects, all other natural resins are of plant origin¹⁰. For the production of lac resin, *Kerria lacca* is the most commonly cultivated insect species. The lac insects live as parasites, feeding on the sap of certain trees and shrubs such as Kusum (*Schleichera oleosa*), Palas (*Butea monosperma*), Ber (*Ziziphus sp.*), Semialata (*Flemingia semialata*) and other minor hosts. It is mostly produced in India, Thailand, China, Myanmar, Bangladesh, Malaya, and Vietnam^{11a,b}. India is the largest producer of lac in the world. The resins obtained from the bark of trees are transparent or translucent solids, semi-solids, or liquid substances and tend to harden when exposed to air. These are water-insoluble and soluble in ordinary solvents, *i.e.*,

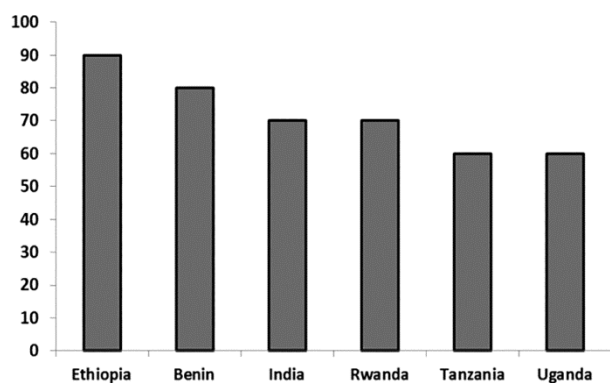


Fig. 1 — Population's percentage in developing countries using traditional medicine for primary healthcare

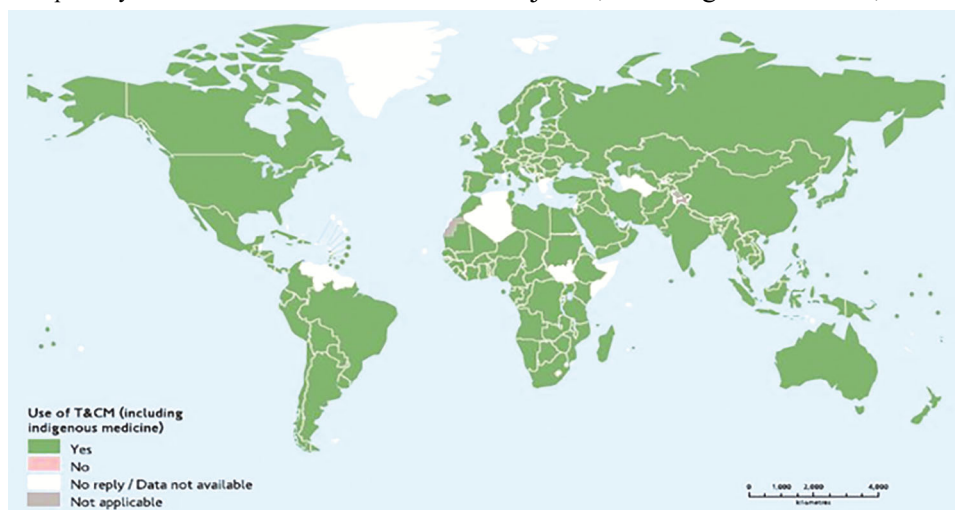


Fig. 2 — Countries using traditional medicine

alcohol, turpentine, and ether. The most common resins are derived from plants like *Vateria indica*, *Canarium strictum*, *Pinus spp.*, *Shorea robusta*, and *Gardenia resinifera*.

Natural gums: Gums are the group of plant products mainly formed by the decomposition of plant cellulose in a process called gummosis¹². Contrary to resins, gums are water soluble and insoluble in alcohol and other organic solvents⁸. A large number of tree species produce a gum. Significant gum-yielding trees are *Sterculia urens*, *Acacia nilotica*, *Anogeissus latifolia*, *Lannea coromandelica*, *Butea monosperma*, and *Azadirachta indica*. Gum is also obtained from the seeds of some plants such as Guar, *Cassia tora*, etc.

Gum-resins: Gum-resins are the mixture of both gum and resin, which have properties of both the groups. Gum resins contain small amounts of essential oils and colouring materials. These are usually secreted from plants growing in arid regions. The most commonly used gum-resin is obtained from *Boswellia serrata* tree, popularly known as salai-guggul.

Oleo-gum resins: Oleo-gum-resins are semi-solid extracts of plants. These are homogenous mixtures of volatile oil, gum, resin, and small quantities of other substances. Some oleo-gum resins are guggul and asafoetida.

NRGs have various applications in medicine and communities' socio-cultural, spiritual, and health needs. Local people use medicinal formulations from the gums and resins obtained from the trees to treat injuries, neurological disorders, and other ailments.

Production statistics in India

In India, almost every state contributes to producing the NRGs of one type. Rajasthan, Gujarat, and Madhya Pradesh have a prime share in the guar gum, babool gum, guggul, and salai. Whereas, Southern states, including Tamil Nadu, Kerala, and Andhra Pradesh, have a significant share of tamarind gum, white dammar, and black dammar. Northern Himalayan states are well known for the production of pine resin, and the remaining central Indian states are among the primary producers of gum karaya, ghatti, jhingan, acacia, and other exudate gums. India is among the leading producers of NRGs in the world, with an estimated output of about 5.2 lakh tons, including about 95.32% gums, 3.6% lac, and 1.08% plant resins for 2019-20¹³. Production of various NRGs in India from 2011 to 2020 is given in Table 1.

India is traditionally the largest producer of guar and karaya gums. The total export of natural resins, gums, and gum-resins during 2019-20 was about 281 thousand tons, valued at Rs. 32.8 billion. There was also an import of about 103 thousand tons of NRGs valued at Rs. 16.7 billion¹³. Processing and value addition of NRGs can further enhance export earnings. Except for lac and guar gum, the processing and value addition of other NRGs is meagre in India. The price of the raw gums collected from the forest depends on the quality, type of gum, and grade. The retail market of natural resins and gums in India is shown in Figure 3.

NRGs as traditional medicines

Some important natural resins and gums used as medicines by the folks are summarized in Table 2. Details of these resins, gum-resins and gum-producing trees with their medicinal uses are explained as follows-

Natural resins

Lac: Lac is used in folk medicine as a hepatoprotective and antiobesity drug. It acts as an astringent, coagulation modifier, antiarthritic, anthelmintic, antipruritic, antihiccup, antiulcerogenic, and antiinflammatory agent¹⁴. It has a great significance as traditional medicine. It is helpful in intestinal parasites, dysentery, diarrhoea, internal bleeding disorders, cough, and skin diseases. Lac is also used in jaundice, leprosy, obesity, chicken pox, renal and spleen disorders, backache problems, ulceration, and epilepsy^{10,14}. It is mixed with guggul and used for joint diseases, osteoporosis, osteomalacia, and osteoarthritis. When taken with other liver-stimulating herbs, it acts as a liver tonic^{14,15}. Medicinal properties of lac are well described in *Unani* literature where it is named as *Luk*. Various *Unani* medicine formulations available in the market have lac as a chief constituent. They cure ailments like hyperlipidaemia, renal, hepatic and spleen disorders, jaundice, leprosy, asthma, epilepsy, worm infestation, and palpitation¹⁵.

Canarium strictum: Black dammar is a tall tree in evergreen, semi-evergreen, and moist deciduous forests.

Table 1 — Total NRG production during 2011-12 to 2019-20 (in tons)

Name of product	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Guar gum	744295	818975	1129134	1094989	938404	601740	638877	580140	502000
Lac	17900	19577	21008	16978	18746	16352	14315	18536	18944
Pine resin	8514	8361	6875	6699	5726	5991	5124	4838	4176
Karaya gum	285	212	129	83	100	83	31	21	24
Dhawda gum	147	380	448	295	194	201	79	66	54
Other gums	716	552	567	333	389	285	77	72	67
Other resins and gums	691	1083	975	1190	980	1140	1500	1400	1500
Grand Total	772549	849140	1159137	1120567	964540	625793	660005	605038	526765

Source: *Lac, Plant Resins and Gums Statistics 2020: (ISSN No. IS- 2454-8782)*



Fig. 3 — Retail marketing of natural resins and gums

Table 2 — Important resins and gums used as traditional medicines					
S. no.	Plant/ Source name	Family	Common name	Part used	Ailment cured
RESINS					
1.	<i>Kerria lacca</i> (<i>A species of insect</i>)	Tachardiidae	Lac insect	resin	Dysentery, diarrhoea, internal bleeding disorders, intestinal parasites, cough, hiccup, jaundice, obesity, skin diseases, leprosy, renal and spleen disorders, backache problems, joint disorders, ulceration, epilepsy, and chicken pox.
2.	<i>Canarium strictum</i>	Sapindaceae	Black dammar	Resin	Diarrhoea and dysentery.
3.	<i>Shorea robusta</i>	Dipterocarpaceae	Sal	Resin	Itching and rashes. Hyperhidrosis, vitiated pitta conditions, wounds, ulcers, neuralgia, burns, pruritus, fractures, fever, diarrhoea, dysentery, haemorrhoids, gonorrhoea, menorrhagia, splenomegaly, obesity, cephalalgia, odontalgia, burning of the eyes and ophthalmodynia.
4.	<i>Vateria indica</i>	Dipterocarpaceae	White dammar	Resin	Cough, chronic bronchitis, throat troubles, skin eruptions, leprosy, crack infection, ulcers, and wounds.
5.	<i>Gardenia resinifera</i>	Rubiaceae	Dikamali	Resin	Headache, running nose, intestinal worms, distension of abdomen, and piles
6.	<i>Pinus spp.</i>	Pinaceae	Chir pine, Blue pine, Khasi pine	Resin	Wounds, bloat
GUM-RESINS					
1.	<i>Boswellia serrata</i>	Burseraceae	Indian frankincense	Gum-resin	Rheumatoid arthritis, asthma, inflammatory bowel disease, and skin diseases
2.	<i>Commiphora wightii</i>	Burseraceae	Guggul	Oleo-gum-resin	Joint pain, thrombosis, chronic bronchitis, nodulocystic acne, spongy gums, and teeth carry.
3.	<i>Convolvulus scammonia</i>	Convolvulaceae	Sakmonia	Gum-resin	Dropsy
4.	<i>Ferula asafoetida</i>	Apiaceae	Hing	Oleo-gum-resin	Hysteria, dental carries, scorpion sting, etc.
5.	<i>Mangifera indica</i>	Anacardiaceae	Mango	Gum-resin	Scabies and parasitic diseases of the skin
GUMS					
1.	<i>Acacia senegal</i>	Fabaceae	Gum Arabic tree	Gum	Diabetes, digestive disorders, etc.
2.	<i>Acacia leucophloea</i>	Fabaceae	White bark acacia	Gum	Intermittent fever
3.	<i>Acacia nilotica</i>	Fabaceae	Babul	Gum	Headache
4.	<i>Aegle marmelos</i>	Rutaceae	Bael	Gum	Diarrhoea and dysentery
5.	<i>Anogeissus latifolia</i>	Combretaceae	Gum ghatti	Gum	Menorrhoea
6.	<i>Astragalus sarcocolla</i>	Fabaceae	Anzaroot	Gum	Joint pain
7.	<i>Azadirachta indica</i>	Meliaceae	Neem	Gum	Constipation
8.	<i>Bombax ceiba</i>	Bombacaceae	Semal	Gum	Toothache
9.	<i>Boswellia ovalifoliolata</i>	Burseraceae	Salai guggul	Gum	Postnatal complaints
10.	<i>Buchanania axillaris</i>	Anacardiaceae	Cuddapah Almond	Gum	Rheumatism
11.	<i>Buchanania lanzan</i>	Anacardiaceae	Chironji	Gum	Intercostal pain, toothache, and leprosy
12.	<i>Butea monosperma</i>	Fabaceae	Palas	Gum	Sores, ulcers, boils, etc.
13.	<i>Caesalpinia crista</i>	Fabaceae	Crested fever nut	Gum	Stomach disorders
14.	<i>Cassia tora</i>	Fabaceae	Cakunda	Gum	Skin diseases, asthma, etc.
15.	<i>Cassia sieberiana</i>	Leguminosae	Drumstick tree	Gum	Sores
16.	<i>Ceiba pentandra</i>	Malvaceae	White Silk-cotton Tree	Gum	Bowel complaints, abnormal uterine bleeding, dysentery, and diarrhoea
17.	<i>Coccinia grandis</i>	Cucurbitaceae	Ivy gourd	Gum	Eye disease
18.	<i>Cochlospermum religiosum</i>	Cochlospermaceae	Katira	Gum	Cough and gonorrhoea
19.	<i>Cyamopsis tetragonoloba</i>	Fabaceae	Guar	Gum	Constipation, diverticulosis, Crohn's disease, colitis, and irritable bowel syndrome

(Contd.)

Table 2 — Important resins and gums used as traditional medicines (Contd.)

S. no.	Plant/ Source name	Family	Common name	Part used	Ailment cured
GUMS					
20.	<i>Enterolobium cyclocarpum</i>	Fabaceae	Ear Pod Tree	Gum	Bronchitis
21.	<i>Feronia limonia</i>	Rutaceae	Wood apple	Gum	Dysentery and diarrhoea
22.	<i>Lannea coromandelica</i>	Anacardiaceae	Jhingam	Gum	Asthma and rheumatism
23.	<i>Moringa oleifera</i>	Moringaceae	Sahjan	Gum	Ear pain, dental caries
24.	<i>Plantago ovata</i>	Plantaginaceae	Isabgol	Gum	Constipation and diarrhoea
25.	<i>Prosopis juliflora</i>	Fabaceae	Mesquite	Gum	Sore throats and irritation of eyes
26.	<i>Pterocarpus marsupium</i>	Fabaceae	Indian Kino Tree	Gum	Toothache
27.	<i>Spondias mombin</i>	Anacardiaceae	Yellow Mombin	Gum	Parasitic diseases
28.	<i>Sterculia urens</i>	Sterculiaceae	Karaya	Gum	Joints pain and muscular strain
29.	<i>Tamarindus indica</i>	Fabaceae	<i>Tamarind</i>	Gum	Stomach ache, constipation, etc.
30.	<i>Terminalia tomentosa</i>	Combretaceae	Asan	Gum	Burns and swellings
31.	<i>Terminalia bellirica</i>	Combretaceae	Baheda	Gum	Urinary disorders

The resin obtained from the tree bark is effective against diarrhoea and dysentery¹⁶.

***Gardenia resinifera*:** Dikamali is endemic to peninsular India. The plant bears small leaves and secretes a gummy matrix or sap at the tip of the leaves and young shoots, known as dikamali or cumbi-gum. The resin from the plant is warmed in coconut oil and applied to the forehead and throat to cure headaches. It acts as an anthelmintic agent. The resin is heated in oil, and the vapour is inhaled to cure the running nose. The resin has antiseptic properties also^{16,17}. According to Ayurveda, it increases appetite, is astringent to the bowels, and relieves the pain of bronchitis, vomiting, and constipation¹⁸. Besides this, the resin of the plant *Gardenia resinifera* is dissolved in water and administered to patients suffering from distension of the abdomen, and piles. People also give a small dose of this resin to kids suffering from intestinal worms¹⁶.

***Pinus roxburghii/ P. wallichiana/ P. kesiya*:** Turpentine oil is obtained from the resin of pine trees. It is an antiseptic, carminative, expectorant, anthelmintic, and abortifacient¹⁹. It is used both in human and veterinary traditional medicine for topical applications due to its wound-healing and germicidal properties²⁰.

***Shorea robusta*:** The multipurpose tree is originally from the Indian subcontinent. Sal tree resin is applied for itching and rashes. The resin is astringent, cooling, antibacterial, constipating, carminative, stomachic, aphrodisiac, expectorant, ophthalmic, and tonic. It helps to cure hyperhidrosis, vitiated pitta conditions, wounds, ulcers, neuralgia, burns, pruritus, fractures, fever, diarrhoea, dysentery, haemorrhoids, gonorrhoea, menorrhagia, splenomegaly, obesity, cephalalgia, odontalgia, burning of the eyes and ophthalmodynia^{21,22}.

***Vateria indica*:** White dammar is endemic to the Western Ghats in Maharashtra, Karnataka, Kerala, and Tamil Nadu. The resin from this tree is chiefly used as an incense material. It is used in chronic bronchitis and throat troubles. It is also used to treat asthma, cough, leprosy, crack infection, skin eruptions, ulcers, and wounds^{23,24}. The resin is also utilized in several antiseptic and anti-inflammatory ointments²⁵.

Gum-resins

***Boswellia serrata*:** Indian frankincense or salai is distributed throughout the dry regions of India. Gum-resin has a rich scent and is used in rheumatoid arthritis, asthma, inflammatory bowel disease, and skin diseases^{17,21,26}. It is also used in indigenous medicine for nervous disease as a diaphoretic, astringent, and ingredient in certain ointments²⁷. Some of the Ayurvedic products containing boswellic acids in the form of capsules or tablets are available in the market. The medicinal formulation, Shallaki[®], contains 125 mg of salai gum resin in each capsule and has excellent anti-inflammatory and analgesic properties²⁸.

***Boswellia ovalifoliolata*:** Salai guggul is found in tropical regions. Its gum is burnt, and the smoke emanating from it is inhaled by women nine days after delivery so that their postnatal complaints can be cured²⁹.

***Commiphora wightii*:** Guggul plants are found in arid and semi-arid regions. The gum of these plants has been used as medicine for centuries. A paste of guggul mixed in warm water can be applied to the joints to reduce joint pain. It acts as an anti-inflammatory, astringent, antiseptic, hypolipidaemic, hypocholesterolemic, antiobesity,

antiarthritic, antimicrobial, and anticancerous agent. It is also reported to help treat chronic bronchitis, thrombosis, chronic tonsillitis, nodulocystic acne, spongy gums, and teeth carry^{16,26}. In Rajasthan, people go to some holy places to treat illness because they believe their disease will be cured. A small dose of guggul is offered to the patients and children by dissolving in water. Guggul, a versatile medicine, cures the majority of diseases, and this is the secret behind people's faith. Other species of Commiphora including *C. agallocha*, *C. caudate* and *C. stocksiana* are also rich in medicinally active phytochemicals.

***Ferula asafoetida*:** The seeds of the hing plant are used as a spice in India. The oleo-gum-resin obtained from the plant is used for hysteria, Dental carries, and scorpion sting. It is also used in case of piles by mixing with *C. mukul* and ghee³⁰.

Gums

***Acacia nilotica*:** Babool tree is abundant in India's tropical and subtropical areas. Its tender twigs are used in India and South East Africa as a toothbrush. The gum has astringent, emollient, liver tonic, antipyretic antiasthmatic, and analgesic properties³¹. This gum is used to cure diarrhoea, dysentery, diabetes, mellitus, sore throat, constipation, and slow metabolism. The gum, mixed with henna leaves (*Lawsonia inermis*), is applied to the forehead to cure headache²⁹.

***Acacia senegal*:** Gum arabic is a deciduous, small, spiny shrub widely cultivated in the parts of Rajasthan (Sind and Ajmer). Due to its high soluble fibre content, raw or cooked gum is used to help lower cholesterol levels, protect against diabetes³², and treat digestive disorders such as irritable bowel syndrome³³.

***Butea monosperma*:** In India, the palas tree is found in dry areas. A tree's bark, seeds, flowers, gum, leaves, and roots are used for different medicinal purposes. It acts as a contraceptive if 50g of gum dissolved in water is given for a week from the fifth day of menstruation³⁴. The gum is a powerful astringent given orally for dysentery and diarrhoea, haemorrhage from the stomach and the bladder, leucorrhoea, and control of ringworm³⁵. Laddu (a sweet dish) of this gum is given to women after delivery which helps in post-delivery restoration of the body and regulates lactation³⁶. It is also used for dressing sores, boils, ulcers, etc.

***Acacia leucophloea*:** This tree, commonly known as a white bark acacia, is cultivated in India, Nepal, Pakistan, Sri Lanka, Myanmar, Thailand, Vietnam, and Indonesia. The seeds of this plant are cooked and eaten. The water-soluble gum obtained from this tree's stem is used in intermittent fever^{17,37}.

***Aegle marmelos*:** Bael tree is native to India. It is also found in many countries like Bangladesh, Thailand, and Nepal. The leaves of this tree are mainly used by the people of the Hindu religion living in India to worship Lord Shiva. The tree's fruit pulp contains gum and is used for treating diarrhoea and dysentery^{38,39}. The syrup made from fruit pulp is also very beneficial.

***Anogeissus latifolia*:** Gum ghatti is found almost all over India⁴⁰. Parts of this tree, such as leaves and roots, contain gallotannin. Its gum is used as a substitute for gum Arabic. For the treatment of menorrhoea in women, this gum is dissolved in water and given orally for three days^{26,29}.

***Astragalus sarcocolla*:** The gum produced from this tree is used for joints and fractures. It is also applied as an ointment in the wounds^{21,24}.

***Azadirachta indica*:** The neem tree is found in abundance all over India. It can be easily seen around temples, roadside, forests, and gardens. It is a multipurpose tree. All the tree parts are used in some form or the other. The gum obtained from the tree trunk, which is edible, is used for the treatment of constipation¹⁶.

***Bombax ceiba*:** The sapling root and the bark of the semal tree secrete a transparent gum containing tannin. This gum is used for toothache⁴¹.

***Buchanania axillaris*:** The seeds and bark of the cuddapah almond are consumed as decoctions to cure intrinsic haemorrhage and diarrhoea. The gum secreted from the tree's trunk is mixed with ashes, garlic, asafoetida, or goat's milk to make a paste and used externally to treat rheumatism²⁹.

***Buchanania lanzan*:** Chironji plant is found almost everywhere in India except in the arid region. The seeds are edible. Its gum is mixed with goat's milk and used to treat intercostal pain⁴² and cure tooth ache⁴¹ and leprosy. Some tribal communities of Andhra Pradesh used the gum to treat rheumatic pains by blending it with cow's milk⁴³.

***Caesalpinia crista*:** Kantkaranj is a prickly shrub that grows to 10 m. The powder of its seeds is used for stomach disorders⁴⁴.

Cassia tora: Cakunda is an annual weed and the gum is obtained from its seeds. The paste of its seeds is applied to skin diseases. Dried seed powder is used in the treatment of asthma⁴⁵. Apart from this, the boiled extract of the seed acts as a carminative, stimulant, and tonic. In traditional Ayurvedic and Chinese medicine, the seeds have been described as an antimicrobial, antihepatotoxic, antidiuretic, and antidiarrhoeal effect⁴⁶.

Cassia sieberiana: Due to the hard wood, this tree is used for making tools, pestles, and mortars. Its gum is used for the treatment of sores⁴⁷. The different parts of the plant have been used for decades in traditional medicine in African countries as a purgative, diuretic, analgesic, antibiotic and anti-inflammatory agent. The pod infusion and yellow pulp around the seed is used as laxative⁴⁸.

Ceiba pentandra: The gum obtained from the bark of the white silk cotton tree is similar to tragacanth gum, identical to that of karaya gum. It is used in dysentery and diarrhoea in children. This gum is also used for stomach diseases and unbalanced uterine bleeding⁴⁹.

Coccinia grandis: Ivy gourd is a vegetable plant whose unripe fruits are eaten. The gum of its fruit is applied externally as an eye ointment²⁹.

Cochlospermum religiosum: This tree is originally from Central and South India. The gum of this tree is used in dysentery, diarrhoea, asthma, stomach disorders, and eye problems. In addition, gum boiled in water is used in case of cough and gonorrhoea^{17,21}.

Convolvulus scammonia: Gum-resin is obtained from the root of the sakmonia tree, which is used to kill roundworms and tape worms. It is also used as a diuretic in dropsy⁵⁰.

Cordia spp.: Many species of the genus *Cordia* have been used for a long to treat several ailments in various Ayurveda, Unani and Siddha medicine. The fruit of the plants is very mucilaginous (fruit gum) and used as a demulcent and blood purifier in the diseased spleen, kidney, and lungs⁵¹.

Cyamopsis tetragonoloba: Guar is mainly grown in India for its pods which are eaten as vegetable and used to relieve constipation, and chronic functional bowel ailments, like diverticulosis, Crohn's disease, colitis, and irritable bowel syndrome¹⁶.

Enterolobium cyclocarpum: Ear pod tree acts as forage for the cattle and shelter of the coffee plantation. The gum of this tree is used as a remedy for bronchitis⁵².

Feronia limonia: The wood apple tree is like a bael tree; its fruits are high in fibre content. The tree is native to India but cultivated in Sri Lanka, Bangladesh, and Pakistan. It is one of the hardy trees of arid and semi-arid regions. It can be grown in dry tracts of tropical and subtropical regions. Powdered wood apple gum, mixed with honey, is given to overcome dysentery and diarrhoea in children⁵³.

Lannea coromandelica: The timber of the jhingan or moi tree is used as plywood due to its excellent termite resistance. This tree and its parts such as leaves, root, bark, flowers and fruits have the potential of antimicrobial, wound healing, and anti-inflammatory activities⁵⁴. Gum obtained from the tree's bark is given as a cordial to women during lactation. It is also used in asthma and rheumatism⁵⁵.

Mangifera indica: The mango tree is found in tropical areas. Its cultivation is done for its fruits. The gum resin from its bark is mixed with coconut oil and applied to scabies and parasitic skin diseases. It is also used for aphthae and sores caused by herpes and syphilis⁵⁶.

Moringa oleifera: This tree is commonly known as sahan. This multipurpose tree is widely cultivated for its young seed pods, leaves, vegetables, and traditional herbal medicine. Gum produced from this tree is heated with sesame oil, and 3-4 drops are poured into ears as ear drops for ear pain and headaches. Gum is used to relieve fevers, dysentery, intestinal complaints, and asthma and is sometimes used as an abortifacient to treat syphilis and rheumatism⁵⁷. It is also effective in treating dental caries as an astringent and controlling blood pressure²⁹. *Moringa concanensis*, also known as bitter drumstick, is also reported to treat fertility problems⁵⁸.

Plantago ovata: Isabgol is a shrub known for its medicinal value in Ayurveda. Dried seeds and the seed husks of *Plantago ovata* are used to relieve constipation and treat diarrhoea⁵⁹. It contains high levels of non-digestible soluble fibers and is viscous and mucilaginous.

Prosopis juliflora: Mesquite is a thorny shrub that grows to 15 feet. Its gum quality is similar to that of *Acacia senegal*. It is used to relieve sore throats and irritation of the eyes. It is also applied to the hairs by mixing with mud to remove lice⁶⁰.

Pterocarpus marsupium: Blood red coloured gum is secreted from the bark of the Indian kinotree, which is used in cases of toothache⁶¹ and urinary discharge⁶².

***Spondias mombin*:** Gum of yellow mombin is utilized as an expectorant and to expel tapeworms^{63,64}.

***Sterculia urens*:** Karaya is native to India. The gum obtained from the tree bark is soaked in water overnight and used as a laxative as it adds bulk to the contents of the intestine^{62,65,66}. A paste of gum is applied for joint pain and muscular strain²⁶.

***Tamarindus indica*:** Tamarind is found almost everywhere in India but is mainly cultivated in South Indian states. Its young pods are used for the manufacture of spices. In Ayurvedic medicine, tamarind seed gum is used as an astringent, coolant, aphrodisiac, stomachic, and constipating tonic^{16,67}. The seed gum also can potentially treat or prevent obesity; gastro-protective effects⁶⁸.

***Terminalia tomentosa*:** The Asan tree is suitable for moist and dry deciduous regions. The bark of this tree looks like a crocodile. Its edible gum is used to treat burns and swellings caused by inflammation¹⁶.

***Terminalia bellirica*:** Baheda is a tall deciduous multipurpose tree. Its fruit is used in Ayurveda which is known as *bibhitaki*¹⁷. After dissolving in water, the gum of this tree is given orally for urinary disorders²⁹. The gum is also used as demulcent and purgative⁶⁹.

Conclusion

NRGs obtained from biological resources have been an important commodity used to cure various illnesses for ages. These can potentially be used as key ingredients of traditional and ethnic medicines. Many people, especially the rural population, still rely on traditional medicines as a primary source of health care to treat various ailments like cold, cough, fever, headache, skin diseases, dental infections, digestive disorders and many other illnesses. These simple but effective home-made remedies are passed from generation to generations due to their connection with people's traditions and their least or no side effects. Although some of the know-how followed as ITKs are scientifically proven effective, many are yet to be explored and established. Hence, it is necessary to study and preserve the knowledge of these traditional medicines through their proper documentation.

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Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Authors' Contributions

NT: Conceptualization, Visualization, Writing - review & editing; UK: Writing - original draft; PS: Review & editing; ARC: Review & editing; VDL: Review & editing and NP: Supervision, Review & editing.

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